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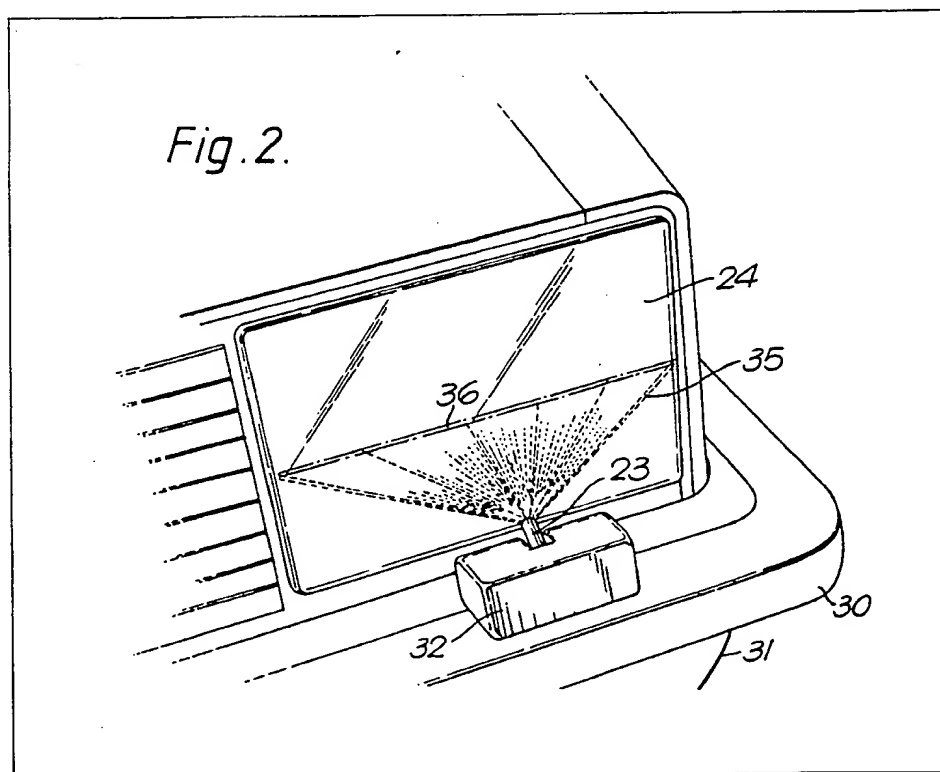
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(54) **Vehicle headlamp cleaning system**

(57) A vehicle headlamp cleaning system has an electric pump for supplying cleaning liquid under pressure to a jet assembly mounted adjacent a headlamp (24) on, for example, a bumper (30). The jet assembly includes a spray nozzle (23) for producing a planar spray (35) of cleaning liquid which impinges on the headlamp (24) in the form of a narrow band (36), and a liquid-pressure operable arrangement for moving the

nozzle such that the narrow band of liquid traverses the headlamp. In one example, the nozzle is angularly displaced. In another example, the nozzle is carried linearly over the headlamp and may have a wiper device attached thereto.

The jet assembly may be mounted in an over-rider and the system may include liquid conserving features such as a pressure-responsive valve and a timing unit for controlling energisation of the pump.



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1/3

Fig. 1.

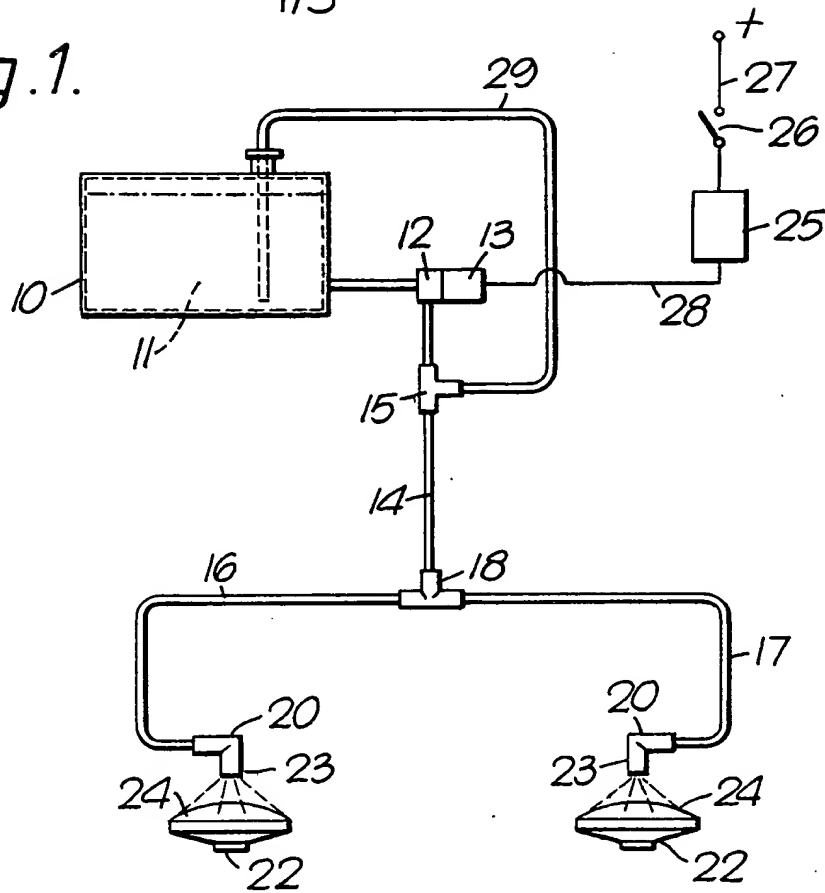
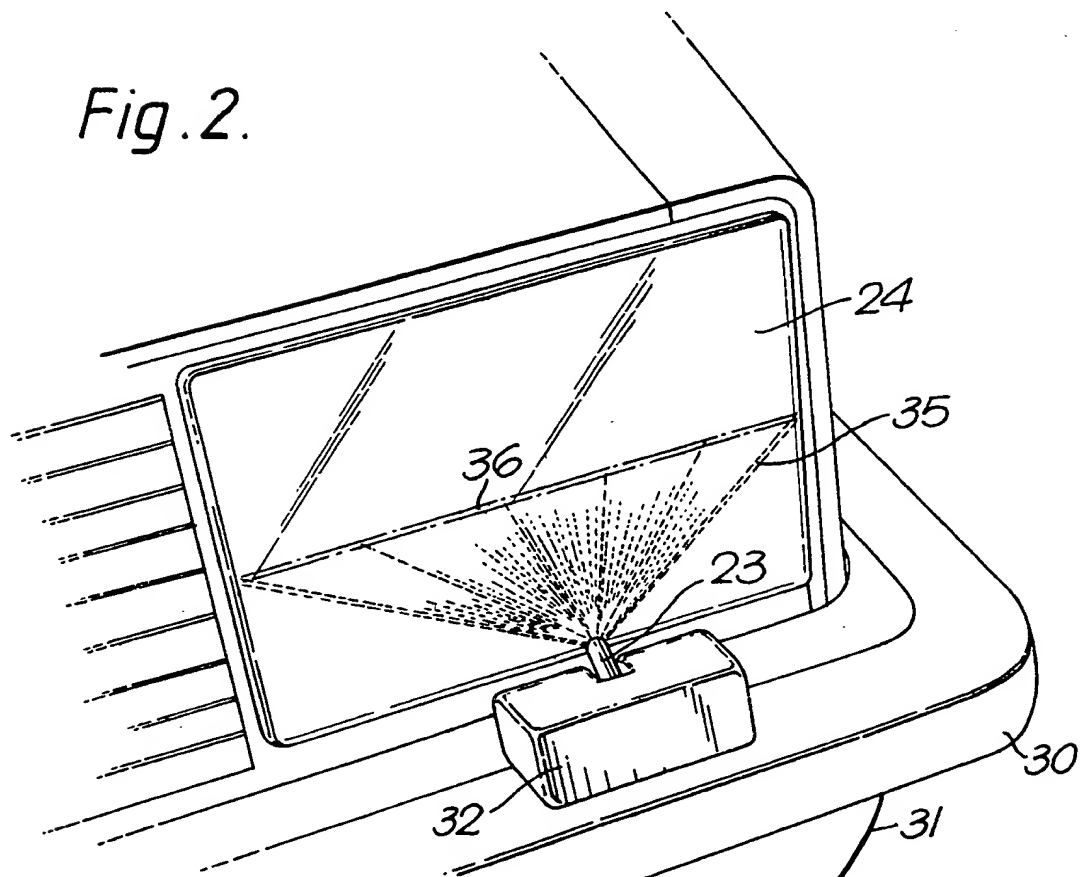


Fig. 2.



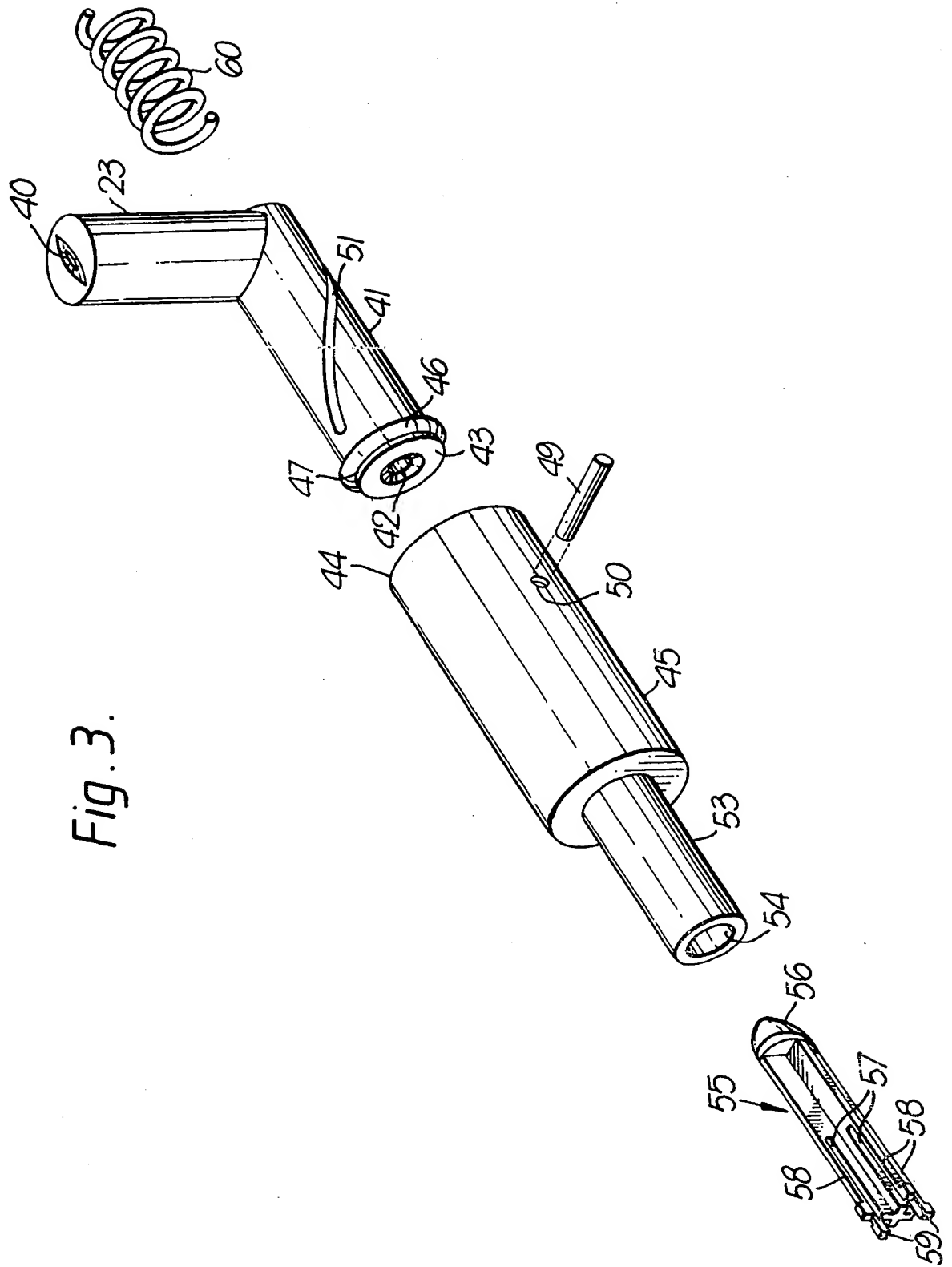


Fig. 3.

3/3

Fig. 4.

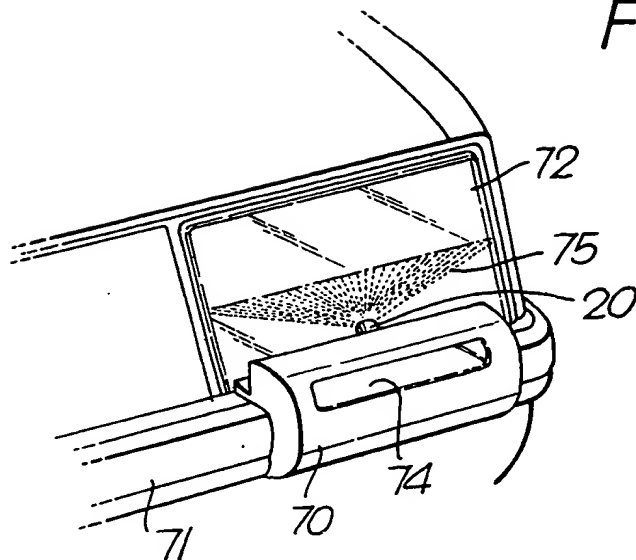


Fig. 5.

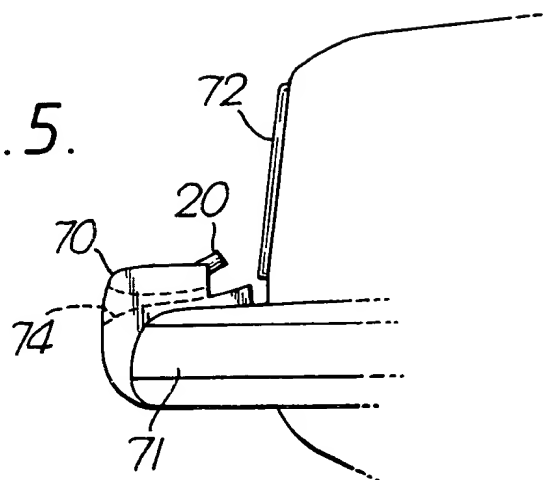
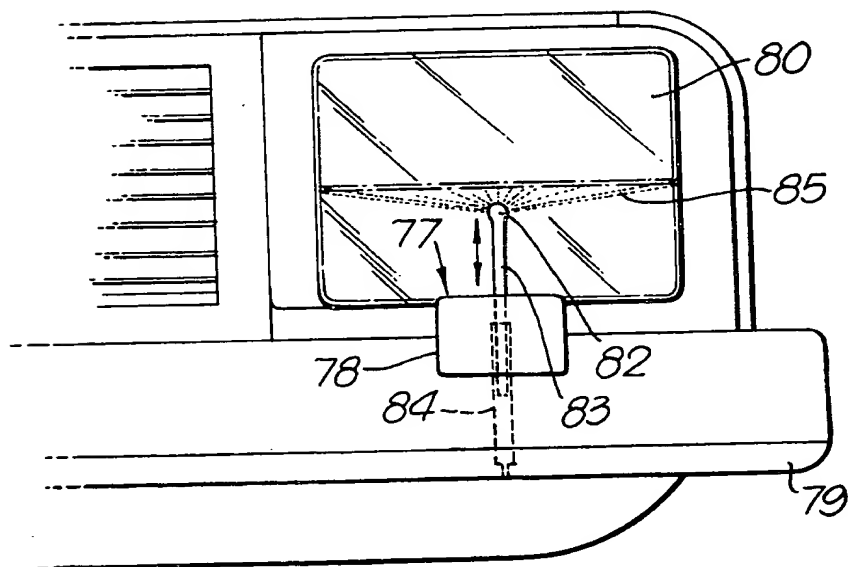


Fig. 6.



SPECIFICATION

Headlamp cleaning system

5 This invention relates to vehicle headlamp cleaning systems.

Vehicle headlamp glasses, like vehicle wind-screens, accumulate dirt and insects on their exposed surfaces and as a result the headlamps suffer
10 from a general reduction in their luminosity. For safety reasons therefore it is preferable that the headlamp glasses be cleaned frequently.

Various systems have already been proposed for cleaning vehicle headlamps. The majority of these
15 proposed systems involve the use of a wiper blade which is driven by an electric motor to traverse the headlamp glass and remove dirt much in the same way that a windscreen wiper operates. However, the provision of an electric motor in such a system
20 increases their cost. Furthermore, it is often difficult, and consequently expensive to install the electric motor and the associated linkage adjacent the headlamp in a vehicle especially when the vehicle has not specifically been designed to accommodate
25 a headlamp glass cleaning system of this type.

Other known headlamp glass cleaning systems attempt to remove dirt from the headlamp glass by means of water alone. These systems involve the use of a fixed nozzle which produces a spray in the
30 form of a solid cone of water droplets which covers substantially the entire surface of the headlamp glass. However these spray systems suffer from the disadvantage that in order to effectively clean the headlamp glass in this manner large quantities of
35 water have to be expended and that powerful pumps are necessary to ensure that each small area of the headlamp glass receives water droplets having sufficient energy to remove the dirt therefrom.

It is an object of the present invention to provide a
40 surface cleaning system for cleaning headlamp glasses which substantially overcomes the disadvantages associated with these known systems. According to one aspect of the present invention, there is provided a vehicle headlamp cleaning
45 system mounted in a vehicle comprising an assembly disposed adjacent a headlamp of the vehicle and means of supplying cleaning liquid under pressure to said assembly, wherein said assembly includes spray means which is arranged to direct said
50 cleaning liquid in the form of a narrow band of liquid onto the headlamp, and means operable by said liquid pressure for moving the spray means relative to the headlamp such that the said narrow band of liquid traverses the headlamp so as to effect clean-
55 ing thereof.

Preferably, the spray means is arranged to produce a substantially planar spray of cleaning liquid which extends across at least a portion of the headlamp. The means for moving the spray means
60 is preferably operable to move the spray means relative to the headlamp such that the narrow band of liquid traverses the headlamp in a direction at right angles to the longitudinal axis of the narrow band of liquid. Preferably, the narrow band of liquid
65 is arranged to tranverse the headlamp from adjacent

one edge thereof to adjacent an opposite edge thereof.

The means operable by the liquid pressure may comprise hydraulic motor means which is arranged
70 to angularly displace the spray means.

Alternatively, the liquid pressure operable means may comprise hydraulic motor means which is arranged to move the spray means linearly across the headlamp. In this case, wiping means, for
75 example a brush, may also be carried with the spray means across the headlamp to effect wiping thereof.

The assembly may be mounted in a housing disposed to the front of the headlamp. The housing may comprise an over-rider for the vehicle bumper
80 and may include air deflecting means which creates a curtain of air over the headlamp during motion of the vehicle.

The means for supplying cleaning liquid under pressure may comprise an electric motor driven
85 pump.

Timing means, operable by momentary operation of a switch, may be included to control the duration of the electric motor.

The spray means may comprise a spray nozzle
90 having a single orifice to produce a substantially planar fan-shaped spray. Alternatively the spray means may comprise an elongate tube having a plurality of orifices along its length which are arranged to produce a substantially planar spray.

The means operable by the fluid pressure for moving the spray means may comprise a chamber for receiving said cleaning liquid supplied from said liquid supply means and a piston member slidably mounted in said chamber for displacement out of
100 said chamber by said liquid pressure. In this case the spray means may be mounted on the piston member. The assembly may include resilient means, for example a spring, which is arranged to urge the piston member into the chamber.

Vehicle headlamp cleaning systems in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawings in which:-

Figure 1 shows schematically a vehicle headlamp
110 glass cleaning system;

Figure 2 is a perspective view of a portion of a vehicle showing a jet assembly of the cleaning system mounted thereon;

Figure 3 shows in exploded form parts of a jet assembly of the cleaning system;

Figure 4 is a perspective view of a front portion of a vehicle showing modified housing for a jet assembly of the cleaning system mounted thereon;

Figure 5 is a side view of the portion of the vehicle
120 shown in *Figure 4*; and

Figure 6 is a front view of a portion of a vehicle showing schematically an alternative form of jet assembly mounted thereon.

Referring to *Figure 1*, the headlamp glass cleaning
125 system generally includes a water reservoir 10 mounted in the vehicle, for example under the bonnet, which contains a supply of water 11. Any suitable washing additive may be mixed with the reservoir water to improve its cleaning performance.
130 Water from the reservoir 10 is fed through a pipe to a

centrifugal pump 12 which is driven by a 12 volt D.C. electric motor 13. When energised, the electric motor 13 drives the pump 12 to pump water under pressure through a pipe 14 to the pipes 16 and 17 via a tee-junction 18. The pipes 16 and 17 are connected to respective jet assemblies 20 mounted adjacent the vehicle headlamps 22. Each of the jet assemblies 20 includes a spray nozzle 23 which directs the pressurised water in the form of a spray comprising high-velocity water droplets onto the headlamp glasses 24 in order to effect cleaning of the glasses 24.

Energisation of the electric motor 13 is controlled by a timing circuit, generally indicated at 25, which is arranged to supply current along a line 28 to the motor 13 and which is itself activated by means of a manually-operable push-button switch 26, mounted on, for example, the dashboard of the vehicle. Depression of the switch 26 connects the timing current 25 to a source of current via a line 27. Electrical power for the timing circuit 25 and the electric motor 13 is derived from the vehicle's electrical system.

A by-pass valve 15 in the pipe 14 normally operates to allow water pumped from the pump 12 under pressure to pass along the pipes 14, 16 and 17 to the jet assemblies 20. However, if the amount of water 11 contained in the reservoir 10 is inadvertently allowed to fall to a level below the output from the reservoir 10 to the pump 12, air is passed to the pump 13 instead of water. It is undesirable to permit air to enter the pipes 14, 16 and 17 as once this happens it is difficult for the pump 12 to force such air out of the system in view of the general inability of centrifugal pumps specifically designed to pump liquids, efficiently to pump air. For this reason, the by-pass valve 15 is arranged to operate in response to the presence of a mixture of air and water in the pipe 14, indicative of the fact that the level of water in the reservoir 10 is about to fall below the level of the output to the pump 12, to re-direct this mixture back into the reservoir 10 via the pipe 29. Alternatively, the by-pass valve 15 may be arranged simply to vent the mixture of air and water to the atmosphere.

Once the supply of water in the reservoir 10 has been replenished, and water alone is pumped to the by-pass valve 15, the valve responds by returning to its initial position and supplying the pressurised water to the pipes 16 and 17.

Referring now to Figure 2, there is shown a side view of a front portion of a vehicle which includes the headlamp glass 24 and a bumper 30 mounted on the vehicle body 31. The jet assembly 20 is contained within a housing 32 securely mounted on the bumper 30 adjacent the lower edge of the headlamp glass 24 with the spray nozzle 23 of the jet assembly 20 directed towards the glass 24. The other jet assembly 20 is similarly contained within a housing mounted adjacent the lower edge of the second headlamp glass 24 (not shown in Figure 2).

As previously mentioned, the spray nozzle 23 operates to direct the pressurised water supplied from the pump 12 onto the headlamp glass 24 in the form of a spray comprising high-velocity droplets of water in order to effect cleaning. More especially

however, the spray nozzles 23 are arranged to provide a substantially flat, fan-shaped spray of water 35 so that a generally horizontally, narrow band 36 of high velocity water droplets, say, less than one-eighth of an inch width, impinges on the headlamp glasses 24 across at least a major portion of the width of the headlamp glasses 24. Furthermore, the spray nozzles 23 are arranged to oscillate between predetermined limits such that this narrow band of high velocity water droplets traverses across the headlamp glasses 24 from substantially adjacent their lowermost edge to their uppermost edge. As a result, the high pressure from the spray nozzle 23 covers substantially the whole of the area of each of the headlamp glasses 24.

The high-velocity droplets of water issued from the nozzles 23 blast dirt and other debris from the headlamp glasses 24. It has been found that approximately 25 ccs of water delivered to the spray nozzle 23 at a pressure in the order of 35lbs per square inch will be sufficient to remove, by blasting, most of the dirt from the headlamp glass 24 when directed once across the glass in the form of a narrow band measuring, say, approximately eight inches in length by one-sixteenth of an inch across and taking approximately half a second to traverse the glass.

In one example of a jet assembly for use in the cleaning system, the oscillatory motion of the spray produced by the spray nozzles 23 is achieved by swivelling the spray nozzles 23 within their respective housings 32 between two predetermined positions. Swivelling of the spray nozzles 23 is conveniently achieved automatically by utilising the pressure of water supplied to each jet assembly 20.

One form of such a jet assembly will now be described with reference to Figure 3 which shows, in exploded form, various operative parts of the jet assembly. The spray nozzle 23 of the jet assembly comprises a generally cylindrical tube having an eye-shaped orifice 40 at its end which is designed to emit water passing therethrough in the form of a generally flat fan-shaped spray.

The spray nozzle 23 is firmly mounted on one end of a cylindrical piston member 41 such that the spray nozzle 23 extends at right-angles to the piston member 41. The piston member 41 has a bore 42 extending axially therethrough which communicates with the bore of the spray nozzle 23 so that the water entering the bore 42 of the piston member 41 through its end face 43 passes through the piston member 41 and the spray nozzle 23 to the orifice 40.

The piston member 41 is slidably mounted within a cylindrical chamber 44 in a sleeve member 45 and is provided with a rubber 'O'-ring 46 retained in an annular groove 47 around its circumference which engages with the wall of the chamber 44 to provide a substantially water-tight seal between the piston member 41 and the sleeve member 45.

Movement of the piston member 41 within the cylindrical chamber 44 of the sleeve member 45 is limited in both an axial and rotational sense by means of a pin 49 which extends through an aperture 50 in the wall of the sleeve member 45 and engages with a generally helical slot 51 on the surface of the piston member 41.

A tubular projection 53 of the member 45 has a bore 54 extending co-axially with the chamber 44 in which a poppet valve 55 is slidably mounted. The poppet valve 55 comprises an elongate member of cruciform cross-section and has a domed head 56 which is shaped substantially to conform with a chamfered entrance to the bore 42 provided on the end face 43 of the piston member 41. Slots 57 are formed in the walls of the poppet valve 55 at one end to provide four resilient fingers 58. Each of the fingers 58 has a projection 59 extending radially outwards at its free end. The resilient fingers 58 deform to facilitate insertion of the poppet valve 55 into the bore 54 of the tubular projection 53. Once inside the bore 54, axial movement of the poppet valve 55 is limited by engagement of the projections 59 with two annular flanges on the internal surface of the tubular projection 53 adjacent respective ends of the bore 54.

The components 23, 41, 45 and 55 are all conveniently moulded from a plastics material such as nylon to prevent erosion and eliminate the requirement for lubrication.

The sleeve member 45, carrying the piston member 41 and the poppet valve 55, is securely mounted within the housing 32 and a helical spring 60 is disposed between a surface of the housing (not shown) and the piston member 41 to urge the piston member 41 into the chamber 44 of the sleeve member 45.

The housing 32 (not shown in Figure 3) is mounted on, for example, a bumper of the vehicle such that the sleeve member 45 is located adjacent and extends substantially parallel to the lower edge of the headlamp glass with the spray nozzle 23 directed towards the headlamp glass. The jet assembly is coupled to the pipe 16, or 17 as the case may be, by sliding the pipe 16 over the tubular projection 53 of the sleeve member 45 and securing it in position by any suitable means.

In operation, water under pressure is supplied from the pump 12 upon energisation of the motor 13 through the tubes 14 and 16 into the bore 54 of the tubular projection 53. The water bears against the back of the domed portion 56 of the poppet valve 55 and forces the domed portion 56 into the chamfered entrance to the bore 42 of the piston member 41 to prevent during this initial stage water flowing into the bore 42. As the pressure of the water builds up in the chamber 44 of the sleeve member 45, it acts on the end face 43 of the piston member 41 to force the piston member 41, with the poppet valve 55 still blocking the entrance to its bore 42, out of the chamber 44 against the action of the helical spring 60.

At a predetermined axial displacement of the piston member 41, indicative of the water pressure reaching a predetermined value, the projections 59 of the resilient fingers 58 of the poppet valve 55 abut against the innermost annular flange on the internal surface of the tubular projection 53 to prevent further axial displacement of the poppet valve 55. Upon still further displacement of the piston member 41, the entrance to the bore 42 of the piston member is uncovered and water is allowed to pass

through the bore 42 and out of the orifice 40 in the spray nozzle 23. Axial movement of the piston member 41 is eventually limited by engagement of the pin 49 with the end of groove 51.

During axial displacement of the piston member 41 in the above manner, the guide pin 49 co-operates with the helical groove 51 on the outer surface of the piston member 41 to impart rotational movement to the piston member 41 in addition to its axial movement whereby the member 41 is made to swivel about its longitudinal axis. This swivelling motion in turn pivots the spray nozzle to cause the continuous and flat, fan-shaped spray of water droplets produced by the orifice 40 to traverse the headlamp glass.

The spring 60 serves to dampen axial movement of the piston member 41 and the poppet valve 55 during their limited travel.

The angle through which the spray nozzle 23 is pivoted and, to a certain extent the rate at which it pivots, is determined by the shape of the groove 51 in the surface of the piston member 41. Thus, by suitably changing the shape of the groove 51, and the dimensions of the orifice 40 in the spray nozzle 23, the jet assembly can accommodate a variety of differently shaped and sized headlamp glasses. For example, if the jet assembly is to be used on a vehicle having taller headlamp glasses, the angle of pivot of the spray nozzle can be suitably increased. In addition, the rate at which the spray nozzle 23 pivots may be varied throughout its pivotal movement to improve the cleaning efficiency for headlamp glasses which have a greater angle of slope.

Upon de-energisation of the electric motor 13, and the subsequent reduction in water pressure, the helical spring 60 acts on the piston member 41 to return it to its initial position within the bore 44. During return of the piston member 41, the domed head 56 of the poppet valve 55 again closes the chamfered entrance to the bore 42 of the piston member 41 to prohibit water escaping through the spray nozzle 23. In this way, water is prevented from being unnecessarily wasted.

Once the piston member 41 and the poppet valve 55 are fully returned to their respective initial positions, the jet assembly is ready for the next operation of the cleaning system.

The substantially flat, fan-shaped sprays produced by the jet assemblies and the resulting narrow bands of high energy droplets of water which impinge upon the respective headlamp glasses have been found to be particularly effective in removing dirt and insects etc. from the headlamp glasses. The energy contained in the pressurised water supplied to each jet assembly is concentrated into a band of water droplets which readily blasts dirt from the headlamp glass, and, by oscillating the spray nozzle of the jet assembly, this band of high energy water droplets is made to sweep over substantially the entire surface area of the headlamp glass. It has been found that this band of water acts in a similar manner to that of a wiper blade to dislodge more stubborn deposits.

As each jet assembly only allows water to pass through its spray nozzle when that water has

reached or exceeds a predetermined pressure, the band of high-energy water droplets impinging on each headlamp glass has substantially constant dimensions.

Referring again now to Figure 1, the timing circuit 25 operates to improve the efficiency of the cleaning system and helps to conserve the quantities of water expended during each operation of the cleaning system. The timing circuit 25 is activated by depression of the manually-operable switch 26, which connects the timing circuit 25 to a source of power along the line 27, and operates to supply electrical power to the electric motor 13 for a predetermined period of time. This period of time corresponds approximately to the time taken for the pump 12 to supply water to the jet assemblies 20 and for the spray nozzles 23, upon receiving the pressurised water, to swivel from their lowermost to their uppermost position as previously described. Hence, the pump motors 12 is de-energised as soon as the sprays from the spray nozzle 23 have completed their travel across the headlamp glasses the spray nozzles 23 then being returned to their initial positions through the action of the spring 60.

Occasionally however, one operation of the cleaning system is not sufficient to remove all the dirt from the headlamp glasses. Therefore, the timing circuit is preferably arranged to effect two such operations automatically in response to one momentary depression of the switch 26 by the driver of the vehicle: the first operation serving to remove some of the dirt from the headlamp glasses and to soak more stubborn deposits, and the second operation serving to remove these soaked deposits. It has been found that the time taken from initial energisation of the pump motor 13 for the jet assemblies 20 to effect one complete upward sweep of the headlamp glasses is in the order of half a second. Thus the timing circuit 13 is conveniently arranged to energise the motor 13 for a period of approximately half a second duration and then to de-energise the motor 13 for an interval of approximately five seconds to allow water from the first operation to soak into the remaining deposits on the headlamp glasses. Finally the motor 13 is energised again for another period of approximately half a second duration. The complete cycle of operation of the cleaning system is controlled by the timing circuit 25 and takes approximately six seconds after which time the timing circuit automatically de-activates itself.

The number of individual operations of the cleaning system effected during each complete cycle may be varied by appropriate modification of the timing circuit 25 to suit particular conditions.

The timing circuit 25 preferably comprises a solid-state timing circuit, for example NE555 integrated-circuit, which operates solid state switches or relays to control the supply of electrical power to the pump motor 13.

With regard to the particular example of the cleaning system described with reference to Figures 1 to 3, the jet assemblies 20 may alternatively be mounted on the vehicle adjacent one side of the headlamp glasses and arranged to produce a narrow

band of high-energy water droplets which extend generally vertically across the headlamp glasses and which are moved from that one side of the headlamp glasses to the opposite side in order to effect cleaning of the headlamp glasses.

Referring now to Figures 4 and 5, there is shown a jet assembly, such as the assembly 20 previously described, which is mounted on a vehicle bumper in a modified housing, generally indicated at 70, which also serves as an over-rider. The housing 70 is securely fixed to the bumper 71 adjacent the lower edge of a headlamp glass 72. The housing 70 is shaped to define a generally rectangular duct 74 through which air is channelled during vehicle motion. The internal walls of the duct 74, as can best be seen in Figure 5, are aerodynamically shaped so as to accelerate air flowing through the duct 74. The outlet of the duct 74 is arranged to direct this accelerated flow of air upwardly across the headlamp glass 72 thereby to create a curtain of air over the surface of the headlamp glass 72 which deflects oncoming dirt and insects away from the surface of the headlamp glass 72. As the droplets of water comprising the spray 75 from the jet assembly 20 are travelling at a high velocity, they are able to penetrate through this air barrier and clean the headlamp glass 72 in the manner described.

Although the cleaning systems hereinbefore described have included jet assemblies in which the spray nozzles are mounted for swivelling movement, the oscillatory nature of the sprays produced by the jet assemblies may be achieved by other means. For example, the spray nozzles of the jet assemblies may be displaced in a linear rather than pivotal fashion so as to move over the headlamps. An example of a cleaning system having jet assemblies in which a spray nozzle is arranged to be moved across a vehicle headlamp glass will now be described with reference to Figure 6.

This cleaning system is similar to the cleaning system described with reference to Figure 1 with the modified jet assemblies being coupled to the pipes 16 and 17 in place of the jet assemblies 20. Figure 6 shows one jet assembly 77 of the cleaning system carried in a housing 78 mounted on a bumper 79 of a vehicle adjacent a headlamp glass 80 of the vehicle. The jet assembly 77 is similar to the jet assembly 20 previously described with reference to Figures 1 to 3 of the drawings except that, instead of being swivelled as in the case of spray nozzles 23 of the jet assembly 20, the spray nozzle 82 of the jet assembly 77 is carried across the headlamp glass 80 by a piston member 83 which is capable of being linearly displaced out of the housing 78 across substantially the height of the headlamp glass 80 when water under pressure is supplied to the jet assembly 77. The piston member 83 is slidably mounted in a vertically-disposed sleeve member 84, which, like the sleeve member 45, contains a poppet valve (not shown in Figure 6) to control the flow of water through a bore in the piston member 83 which communicates with the spray nozzle 82. The increase in the permitted axial displacement of the piston member 83 necessary to enable the piston member 83 to traverse substantially the height of the

headlamp glass 80 is achieved by appropriately lengthening the piston member 83 and its associated sleeve member 84. The piston member 82 preferably includes a slot (not shown) which extends along its outer surface parallel to the longitudinal axis of the piston member 83 which co-operates with a guide pin (also not shown) in the sleeve member 84, to prohibit rotation of the piston member 83 relative to the sleeve member 84 during its travel out of and into the sleeve member 84.

The spray nozzle 82 is arranged to produce a substantially flat, fan-shaped spray, indicated at 85, which, in contrast to the spray produced by the nozzle 23 of the jet assembly 20, extends generally transversely of the longitudinal axis of the piston member 83.

A spring (not shown) is connected between the piston member 83 and the housing 78 and acts in a similar manner to the spring 60 of the jet assembly 20 to urge the piston member 83 into the sleeve member 84.

In operation, water is supplied from the pump 12 under pressure to the jet assemblies 77 adjacent the headlamp glasses on the vehicle. When sufficient pressure has been generated and the piston members 83 have been displaced by a certain extent, the poppet valves in the jet assemblies 77 uncover the bores of their associated piston members 83 and water is passed through the spray nozzles 82 and is directed onto the headlamp glasses 80 in the form of a substantially flat, fan-shaped spray that extends horizontally across the headlamp glasses 80. The pressure of water within the sleeve members 84 of the jet assemblies 77 forces the piston members 83 further out of the sleeve members 84 such that the spray nozzles 82 are carried from adjacent the lower edge of their respective headlamp glasses 80 across the headlamp glasses 80 to a piston adjacent the upper edge of the headlamp glasses 80. In this way, the horizontal band of high-energy water droplets impinging on the headlamp glasses 80 is moved across substantially the entire surface of the headlamp glasses 80.

When the piston members 83 reach their uppermost position, the timing circuit 25 operates to de-energise the pump motor 13 whereupon the water pressure in the jet assemblies 77 decreases and the piston members 83 are returned to their initial positions under the action of the aforementioned springs.

The jet assemblies 77 may alternatively be mounted adjacent one side of the headlamp glasses 80 and arranged to produce a spray which extends generally vertically across the headlamp glasses 80. In this way, the piston members 83 are displaced horizontally to carry the spray nozzles 82 from one side of the headlamp glasses 80 to the other.

It is envisaged that in some situations, the space available on a vehicle to accommodate the jet assemblies 77 may be at a premium. For this reason, the piston members 83 may comprise telescopic assemblies which are arranged such that water supplied to the jet assemblies 77 under pressure acts to extend the telescopic piston members 83 and thereby carry the spray nozzles 82 across the

headlamp glasses 80. Upon de-energisation of the pump motor 13, the piston members 83 telescope under the influence of their associated springs and are returned back into their respective housings 78.

By linearly displacing the spray nozzles of the jet assemblies in the above described manners, the angle of impact of the high-energy water droplets on the headlamp glasses, which may be in the order of 90°, and the distance between the spray nozzles 82 and the headlamp glasses is maintained substantially constant as the narrow band of water is moved across the headlamp glasses. Cleaning systems using such jet assemblies have proved particularly effective in removing dirt over the whole surface of the headlamp glasses.

It may be desirable, especially when cleaning headlamp glasses which comprise flat surfaces that are sloped away from the jet assemblies, to arrange that the spray nozzles of the cleaning system follow the contour and slope of the headlamp glasses more closely. This is conveniently achieved by pivotally mounting the jet assemblies 77 in their respective housings 78 about an axis extending generally transversely of the piston member 83 and parallel to the surfaces of the headlamp glasses, and biasing the spray nozzles 82 towards their respective headlamp glass such that the spray nozzles 82 follow the contours and slope of the headlamp glasses at a predetermined distance away from the headlamp glasses during their travel across the headlamp glasses. For example, each jet assembly 77 may include a spring which is disposed between the housing 78 and the piston members 83 and which is arranged to urge the piston member 83 and with it the spray nozzle 82, towards the surface of the headlamp glass. In this case, the piston member 83, or the spray nozzle 82 may carry a roller arrangement which bears against the surface of the headlamp glass so that the spray nozzle 82 is maintained at a predetermined distance away from the surface of the headlamp glass during displacement of the piston member 83. In this way, the spray nozzles 82 can be made to follow the contours and slopes of a variety of differently shaped and orientated headlamp glasses.

Furthermore, each jet assembly may include a brush that is carried with the spray nozzle 82 to assist in the removal of dirt from the headlamp glasses. The brush may be elongate and mounted on the piston member 83 adjacent the spray nozzle 82 to extend parallel to the band of water produced by the spray nozzle 82 and bear against the surface of the headlamp glass. In this case, the brush may replace the roller previously mentioned and serve to maintain the spray nozzle at a predetermined distance from the surface of the headlamp glass during travel of the spray nozzle 82 across the headlamp glass.

In each of the embodiments described above, the jet assemblies have included a spray nozzle, such as at 23 and 82, which is provided with a single orifice designed produce a substantially flat fan-shaped spray of high-energy water droplets. It is envisaged that other spray nozzles may be utilised in the jet assemblies of the cleaning systems to provide a spray which impinges on the headlamp glass in the

form of a narrow band of water droplets. One such alternative spray nozzle includes an elongate tube having a plurality of apertures formed through its wall at regular intervals along its length which

5 combine to produce a generally planar spray. In for example, the jet assembly 20 described with reference to Figure 3, this alternative spray nozzle may comprise a 'T'-shaped arrangement which is secured at one end of the piston member 41 with the
10 elongate tube having the plurality of apertures extending generally parallel to the piston members 41. As the piston member 41 swivels during operation of the cleaning system, the substantially planar spray produced by the 'T'-shaped spray nozzle
15 sweeps across the headlamp glass. alternatively, an 'L'-shaped arrangement may be used in which water is fed to the elongate tube adjacent one end of the tube rather than the mid-point as in the case of the 'T'-shaped arrangement. The 'L'-shaped nozzle spray
20 enables the jet assembly 20 and its housing 32 to be positioned adjacent one corner of the headlamp glass 24 with the elongate tube extending from the jet assembly across the headlamp glass.

Of course, both the 'T'-shapes and 'L'-shaped
25 spray nozzles can be used with the jet assemblies described with reference to Figure 6.

CLAIMS

30 1. A vehicle headlamp cleaning system mounted in a vehicle comprising an assembly disposed adjacent a headlamp of the vehicle and means for supplying cleaning liquid under pressure to said assembly, wherein said assembly includes spray
35 means which is arranged to direct said cleaning liquid in the form of a narrow band of liquid onto the headlamp, and means operable by said liquid pressure for moving the spray means relative to the headlamp such that the said narrow band of liquid
40 traverses the headlamp so as to effect cleaning thereof.

2. A vehicle headlamp cleaning system according to Claim 1, wherein said spray means is arranged to produce a substantially planar spray of cleaning
45 liquid which extends across at least a portion of the headlamp.

3. A vehicle headlamp cleaning system according to Claim 2, wherein said means for moving said spray means is operable by said liquid pressure to
50 move said spray means relative to the headlamp such that the said narrow band of liquid traverses the headlamp in a direction substantially at right angles to the longitudinal axis of said narrow band of liquid.

4. A vehicle headlamp cleaning system according to Claim 2 or Claim 3, wherein said means operable by said liquid pressure is arranged to move
55 said spray means relative to the headlamp such that the narrow band of liquid produced thereby traverses said headlamp from adjacent one edge thereof to adjacent an opposite edge thereof.

5. A vehicle headlamp cleaning system according to any one of the preceding claims, wherein said means operable by said liquid pressure comprises
65 hydraulic motor means having an output which is

operable to angularly displace said spray means.

6. A vehicle headlamp cleaning system according to any one of Claims 1 to 4, wherein said means operable by said liquid pressure comprises hydraulic
70 motor means having an output which is operable to move said spray means across the headlamp.

7. A vehicle headlamp cleaning system according to any one of Claims 1 to 4, wherein said means operable by said fluid pressure for moving said
75 spray means comprises a chamber for receiving said cleaning liquid supplied from said liquid supply means and a piston member slidably mounted in said chamber for displacement out of said chamber by said liquid pressure.

8. A vehicle headlamp cleaning system according to Claim 7, wherein liquid-tight sealing means is disposed between said piston member and the wall of said chamber.

9. A vehicle headlamp cleaning system according to Claim 7 or Claim 8, wherein said assembly includes resilient means which is arranged to urge
85 said piston member into said chamber.

10. A vehicle headlamp cleaning system according to Claim 9, wherein said resilient means comprises a spring.

11. A vehicle headlamp cleaning system according to any one of Claims 7 to 10, wherein said spray means is mounted on said piston member.

12. A vehicle headlamp cleaning system according to Claim 11, wherein said piston member has a bore therein which communicates with said spray means for supplying liquid to said spray means.

13. A vehicle headlamp cleaning system according to Claim 12, wherein said bore in the piston
100 member opens into said chamber.

14. A vehicle headlamp cleaning system according to any one of Claims 7 to 13, including valve means which is responsive to said fluid pressure to prevent supply of liquid to said spray means until a
105 predetermined liquid pressure is attained.

15. A vehicle headlamp cleaning system according to Claim 14 and Claim 13, wherein said valve means includes a part which is arranged to close said bore of the piston member until a predetermined liquid pressure is attained.

16. A vehicle headlamp cleaning system according to Claim 15, wherein the said part is arranged to uncover the bore of said piston member upon a predetermined displacement of said piston member
110 out of said chamber so as to allow said liquid to pass from said chamber to said spray means.

17. A vehicle headlamp cleaning system according to any one of Claims 7 to 16, wherein said assembly includes means operative during displacement of said piston member out of said chamber for rotating said piston member about its axis of
120 displacement.

18. A vehicle headlamp cleaning system according to Claim 17, wherein said rotation means comprises a groove formed on a surface of said piston member and an immovable pin member which engages said groove.

19. A vehicle headlamp cleaning system according to any one of Claims 17 and 18 and Claim 11,
130 wherein said spray means is mounted on said piston

member such that rotation of said piston member during displacement thereof out of the said chamber causes the said spray means to pivot about said rotational axis of the piston member.

5 20. A vehicle headlamp cleaning system according to any one of the preceding claims, wherein said assembly is mounted in a housing disposed to the front of said headlamp.

10 21. A vehicle headlamp cleaning system according to Claim 20, wherein said housing is mounted on a bumper of the vehicle and serves as an over-rider.

22. A vehicle headlamp cleaning system according to Claim 20 to 21, wherein said housing includes air deflecting means for creating a curtain of air
15 across the surface of the headlamp during motion of the vehicle.

23. A vehicle headlamp cleaning system according to any one of Claims 7 to 16 and Claim 11, wherein said spray means is mounted on said piston
20 member so as to be carried across said headlamp during displacement of said piston member out of said chamber.

24. A vehicle headlamp cleaning system according to any one of Claims 7 to 16 and Claim 11,
25 wherein said piston member is telescopic and is extendable by said liquid pressure to carry said spray means across the headlamp.

25. A vehicle headlamp cleaning system according to Claim 23 or Claim 24, including means for
30 maintaining said spray means at a substantially constant distance from the headlamp during movement of the spray means across the headlamp.

26. A vehicle headlamp cleaning system according to Claim 25, wherein said distance maintaining
35 means includes means for biasing said spray means towards the headlamp.

27. A vehicle headlamp cleaning system according to Claim 23 or Claim 24, wherein said piston
40 member also carries wiping means for wiping the headlamp.

28. A vehicle headlamp cleaning system according to Claim 27, wherein wiping means extends in a direction substantially parallel to said narrow band
of liquid.

45 29. A vehicle headlamp cleaning system according to Claim 27 or Claim 28, wherein said wiping means comprises a brush.

30. A vehicle headlamp cleaning system according to any one of the preceding claims, wherein said
50 spray means comprises a spray nozzle having a single outlet orifice which is arranged to produce a substantially planar fan-shaped spray of cleaning liquid.

31. A vehicle headlamp cleaning system according to any one of Claims 1 to 29, wherein said spray
55 means comprises an elongate tube having a plurality of outlet orifices along its length which are arranged to produce a substantially planar spray of cleaning liquid.

60 32. A vehicle headlamp cleaning system according to any one of the preceding claims, wherein said means for supplying cleaning liquid under pressure comprises a pump.

33. A vehicle headlamp cleaning system according to Claim 32, wherein said pump is driven by an

electric motor.

34. A vehicle headlamp cleaning system according to Claim 33, including timing means which is operable to energise said electric motor for a
70 predetermined period of time upon momentary operation of a switch.

35. A vehicle headlamp cleaning system according to Claim 34, wherein said period of time substantially corresponds with the time taken for the
75 narrow band of liquid to traverse the headlamp upon energisation of the said pump.

36. A vehicle headlamp cleaning system substantially as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.

80 37. A vehicle headlamp cleaning system substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings.

38. A vehicle headlamp cleaning system substantially as hereinbefore described with reference
85 to Figures 1 to 6 of the accompanying drawings.

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